

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 June 2004 (03.06.2004)

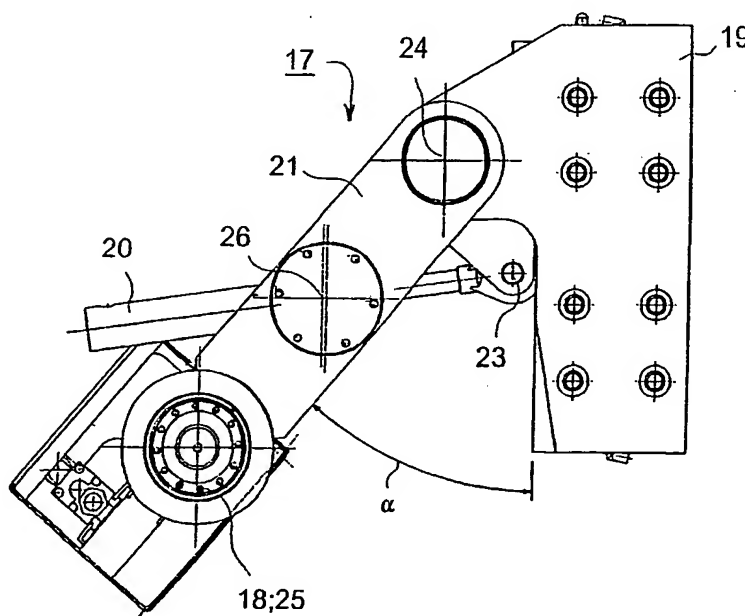
PCT

(10) International Publication Number
WO 2004/046004 A1

- (51) International Patent Classification?: **B65H 18/10**, 10/02 (74) Agent: **FORSSÉN & SALOMAA OY**; Eerikinkatu 2, FIN-00100 Helsinki (FI).
- (21) International Application Number: **PCT/FI2003/000853** (81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, EG, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT (utility model), PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (22) International Filing Date: **11 November 2003 (11.11.2003)**
- (25) Filing Language: **English**
- (26) Publication Language: **English**
- (30) Priority Data: **20022037** **15 November 2002 (15.11.2002)** **FI**
- (71) Applicant (*for all designated States except US*): **METSO PAPER, INC.** [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- (72) Inventor; and
- (75) Inventor/Applicant (*for US only*): **HAAPANEN, Jaakko** [FI/FI]; Huvilakatu 16 A 3, FIN-04400 Järvenpää (FI).

[Continued on next page]

(54) Title: **CORE LOCKING DEVICE**



(57) Abstract: The invention relates to a core locking device comprising members (25) for locking the device (17) to a winding core of a roll to be wound on a two-drum winder, advantageously to a core, which device (17) is placed on a slide arranged in connection with the two-drum winder, which locking device (17) moves, as winding progresses, with the centre of the roll being formed along the slide. The device (17) comprises an actuator (20) to produce a counterforce for the force caused by the mass of the core locking device (17) in the changed position of the core locking device (17).

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Core locking device

- 5 The invention relates to a core locking device according to claim 1.

10 In the prior art, slitter-winders are known in which two-drum winders are used for winding component rolls after slitting a web. In the prior art there are known variable geometry two-drum winders in which one or both of the winding drums/sets of drums supporting the roll are movable. In such variable geometry slitter-winders, the horizontal location of the centre of the roll that is building up is dependent on the relative position of the winding drums/sets of drums and on the diameter of the roll. In winders, rolls are wound around cores. Longitudinal successive cores are locked in place to form a core line by means of a core locking device placed at both ends. In the prior art, a core locking device is known which is placed on a slide arranged in connection with a winder so as to be movable when the diameter of the roll increases as its centre is displaced. Thus, the position of the core locking device changes during operation. The position of the core locking device that moves upwards on the slide also changes when the pivoting angle changes while in the variable geometry winder one or both drums move as winding progresses. When the core locking device pivots, the pivoted core locking device causes a force in the centre of the roll, which force is dependent on the pivoting angle and on the mass of the device. This may cause problems during winding because the magnitude of the force cannot be affected.

25

In addition, in the prior art two-drum winders, mechanical guides, which limit the utilization of space, have been used for set change for guiding the core locking device to a correct position according to core size.

- 30 One problem with winding is also the so-called bouncing phenomenon in which a roll/rolls start bouncing in the winder.

An object of the invention is to provide a core locking device in which the changing of the position of the core chuck as winding progresses does not cause winding problems nor a force acting on the centre of the roll.

5

A non-indispensable further object of the invention is to provide an arrangement in which no mechanical guides limiting the utilization of space are needed for set change in the two-drum winder. Further, a non-indispensable additional feature of the invention is to create an arrangement which makes it possible to detect the occurrence of a bouncing phenomenon and, when needed, to eliminate it.

10

With a view to achieving the objects described above as well as the ones coming out later, the core locking device according to the invention is mainly characterized in what is stated in the characterizing part of claim 1.

15

In accordance with the invention, an actuator is placed in connection with the core locking device, preferably in connection with a pivot joint of the core locking device, which actuator produces a counterforce that is equal to the force caused by the mass of the core locking device in the changed position of the core chuck. In that connection, the core locking device is "weightless" at all pivoting angles, thus not affecting winding and the structure of the roll. The force caused by mass can be static and/or dynamic.

20

During set change, in the device in accordance with the invention, the device is driven by means of a relief actuator to a correct position depending on core size. When the roll positions, diameters and the core diameter are known, the position of the core centre can be calculated.

25

The invention can also be made use of in case it is desired to measure the effect of horizontal forces on the winding process or tune the actuator to function either as an active damper or as a passive damper. Passive damping can be accomplished,

30

for example, when using a hydraulic actuator, such that flow is throttled or flow is restricted, i.e. the damping of the system is changed. In active damping, the position/pressure of the actuator is measured and the variable that determines the action of the actuator is changed based on the result of measurement.

5

In accordance with an advantageous additional application of the invention, the device can be used for detecting the bouncing phenomenon when an angle sensor that measures the pivoting angle is placed in connection with the actuating member; the bouncing phenomenon can be detected based on the measurements
10 of the angle sensor and, when needed, a counterforce can be produced by means of the actuator to eliminate the bouncing phenomenon.

In addition, in two-drum winders which use as one winding drum a set of drums with a belt disposed around it, the device in accordance with the invention makes
15 it possible to compensate for the change of the starting position of winding caused by wear of the belt. Wear of the belt affects the location of the core and thus also the location of the locking device. When the locking device is lowered onto the drums, the device can be "calibrated" and wear of the belt can also be inferred from the starting position.

20

The invention is particularly suitable for two-drum winders in which the rear winding drum is arranged to be movable. In two-drum winders the movement of the rear drum makes it possible to affect the winding properties and achieve quick set change.

25

In accordance with the invention, the state of the actuating member is advantageously measured in the centre of a joint, for example, by means of an angle sensor placed at the end of the joint or by means of a distance measuring sensor or a force sensor placed inside the actuator, preferably a cylinder, thus
30 making it possible to produce a counterforce of desired magnitude in order that

the force caused by the core chuck in the centre of the roll shall not cause winding problems.

5 In the following, the invention will be described in greater detail with reference to the figures of the appended drawing, but the invention is by no means meant to be narrowly limited to the details of them.

Figures 1A and B schematically show a variable geometry two-drum winder and a
10 core locking device placed in connection therewith, in extreme positions of the core locking device.

Figures 2A-2B schematically show extreme positions of the core locking device in accordance with one exemplifying embodiment of the invention.

15 Figure 3 schematically shows the core locking device in accordance with one application of the invention.

As shown in Figs. 1A and B, a paper roll 10 is wound on a two-drum winder which, in the application shown in the figures, is formed of a set of belt drums 11
20 in which an endless belt 14 is placed around two drums 12, 13. The other set of drums of the two-drum winder is formed of a drum 15.

Figs. 1A and B show two different phases of winding, of which the situation occurring in the end phases of winding is shown in Fig. 1A and the situation
25 occurring in the initial phase of winding is shown in Fig. 1B.

At the beginning of winding, as shown in Fig. 1B, a core locking device, i.e. a core chuck 17 is situated on a slide 16 in a lower position, and an arm 21 of the core locking device (Fig. 2) has not pivoted around a joint 24 (Fig. 2). In that
30 connection, the core locking device 17 does not produce a force in the centre 18 of the roll 10. When winding has made progress, Fig. 1A, the core locking device 17

moves with the centre 18 of the roll being formed forwards on the slide 16, so that the core locking device 17 will gradually be at an angle with respect to the slide 16, with the result that a force is produced in the centre 18 of the roll 10 because of the weight of the core locking device 17.

5

In accordance with one application of the invention shown in Figs. 2A and 2B, an actuator 20, advantageously a cylinder – the figure shows a hydraulic cylinder arrangement but, for example, a semi-rotary actuator is also suitable – is placed in connection with the core locking device 17. As shown in the figure, when the pivoting angle α of the core chuck 17 increases, by means of the cylinder 20 a force is produced that acts on the centre 18 of the core cancelling out the force caused by the pivoting angle α . A structure connected with the slides 16 of the core chuck 17 is designated by 19 and the actuator 20 is attached to a pivot point 23 of the frame structure 19 and to a pivot point 26 of the pivoting arm 21 of the core chuck 17, which actuator 20 pivots when the angle α increases in a corresponding manner as the core chuck 17 pivots around the joint 24.

In Fig. 3, the parts of the core locking device or the core chuck 17 of the invention corresponding to those of Figs. 2A and 2B are designated by the same reference signs. The actuator 20 in accordance with the invention, by means of which the force produced by the pivoted core chuck 17 in the centre of the roll 10 is cancelled out, is attached through the pivot point 23 to the frame structure 19 of the core locking device 17, which frame structure 19 is connected to the slide 16 in the winder. In the figure, the locking member placed in the centre 18 of the roll is designated by the reference numeral 25.

A sensor 27 is arranged in connection with the actuator 20 for detecting the pivoting angle α of the core locking device 17 to determine the magnitude of the necessary counterforce to be produced by means of the actuator 20 for cancelling out the force caused by the weight of the core locking device 17 at the angle α .

The invention is in accordance with an advantageous application, the bouncing phenomenon can be detected and eliminated by means of the actuator 20 and the sensor 27.

- 5 Above, the invention has been described only with reference to some of its advantageous exemplifying embodiments, but the invention is not by any means meant to be narrowly limited to the details of them.

Claims

1. A core locking device comprising members (25) for locking the device (17) to a winding core of a roll to be wound on a two-drum winder, advantageously to a core, which device (17) is placed on a slide (16) arranged in connection with the two-drum winder, which locking device (17) moves, as winding progresses, with the centre of the roll being formed along the slide (16), **characterized** in that the device (17) comprises an actuator (20) to produce a counterforce for the force caused by the mass of the core locking device (17) in the changed position of the core locking device (17).
2. A device as claimed in claim 1, **characterized** in that the actuator (20) is a hydraulic cylinder.
3. A device as claimed in claim 1, **characterized** in that the actuator (20) is a semi-rotary actuator.
4. A device as claimed in any one of the preceding claims, **characterized** in that an angle sensor (27) is arranged in connection with the actuator (20) for measuring the pivoting angle (α) of the core locking device (17) to determine the magnitude of the necessary counterforce.
5. A device as claimed in claim 1-2, 4, **characterized** in that the actuator (20) and the sensor (27) arranged in connection therewith are arranged to form an active damper in which the action of the actuator (20) is changed based on the measurement result provided by the sensor (27).
6. A device as claimed in claim 1 or 2, **characterized** in that the actuator (20) is arranged to form a passive damper in which the actuator (20) is a hydraulic cylinder, a change in damping being achieved by changing the flow of the hydraulic cylinder.

7. A device as claimed in any one of the preceding claims, **characterized** in that the actuator (20) and the sensor (27) arranged in connection with the device (17) are arranged to serve as a device that detects and/or eliminates the bouncing phenomenon.

8. A device as claimed in any one of the preceding claims, **characterized** in that in two-drum winders which use as one winding drum a set of drums (11) around which a belt (14) has been disposed, the change of the starting position of winding caused by wear of the belt (14) can be compensated for by means of the location of the device (17).

9. A device as claimed in any one of the preceding claims, **characterized** in that the force caused by the mass of the core locking device (17) is static and/or dynamic.

10. A device as claimed in any one of the preceding claims, **characterized** in that the device (17) is disposed in connection with a variable geometry two-drum winder.

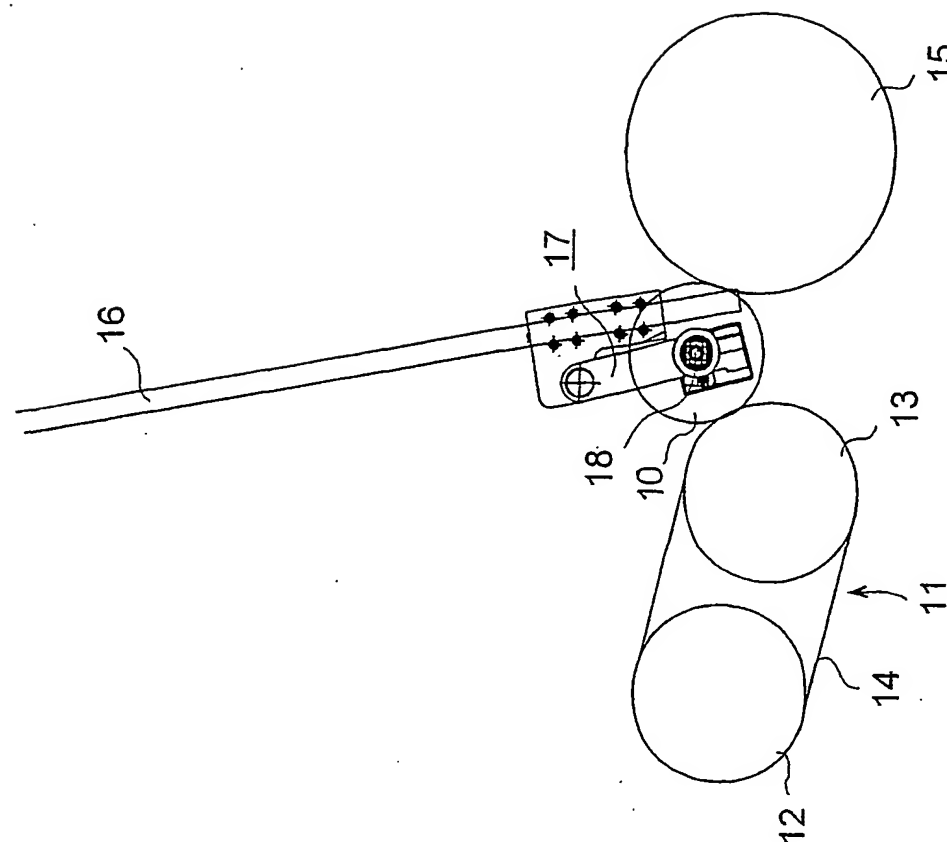


FIG. 1B

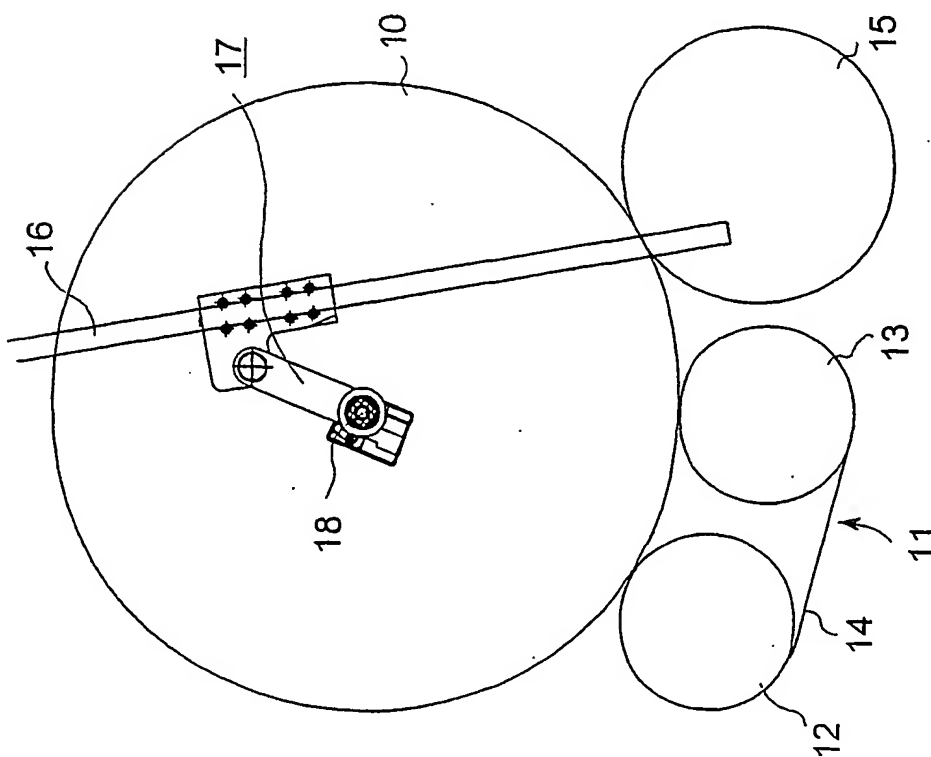


FIG. 1A

2/3

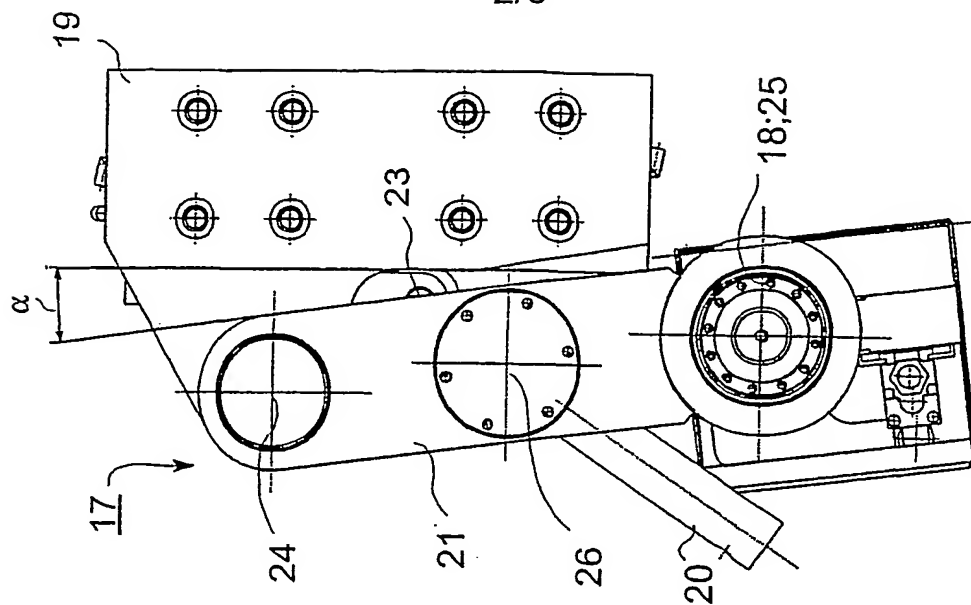


FIG. 2B

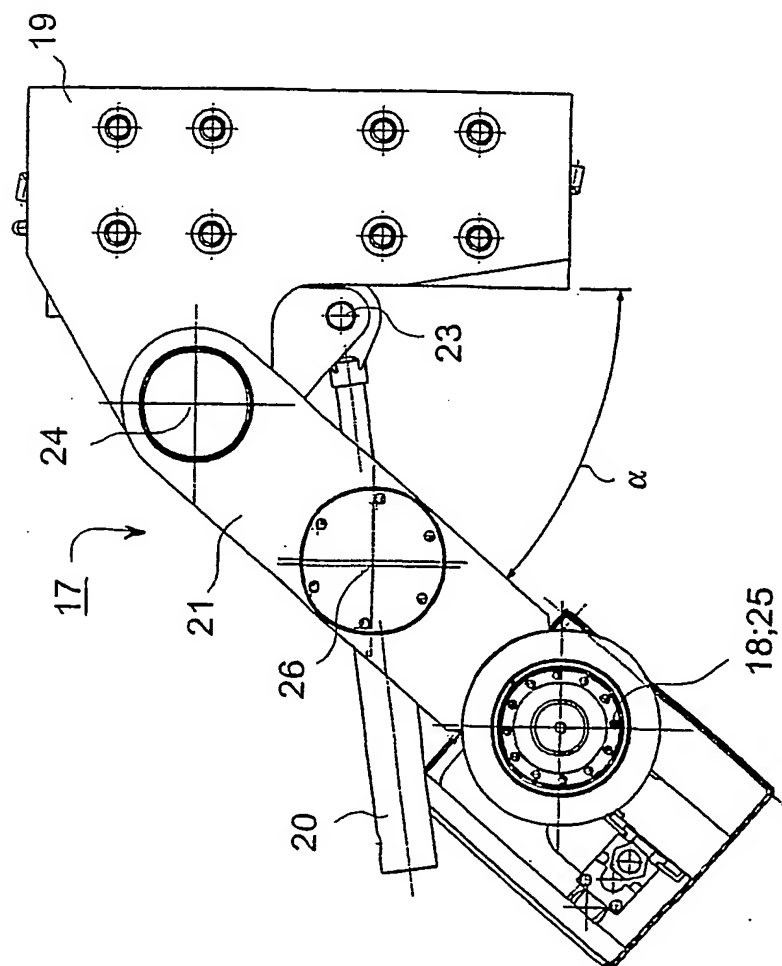


FIG. 2A

3/3

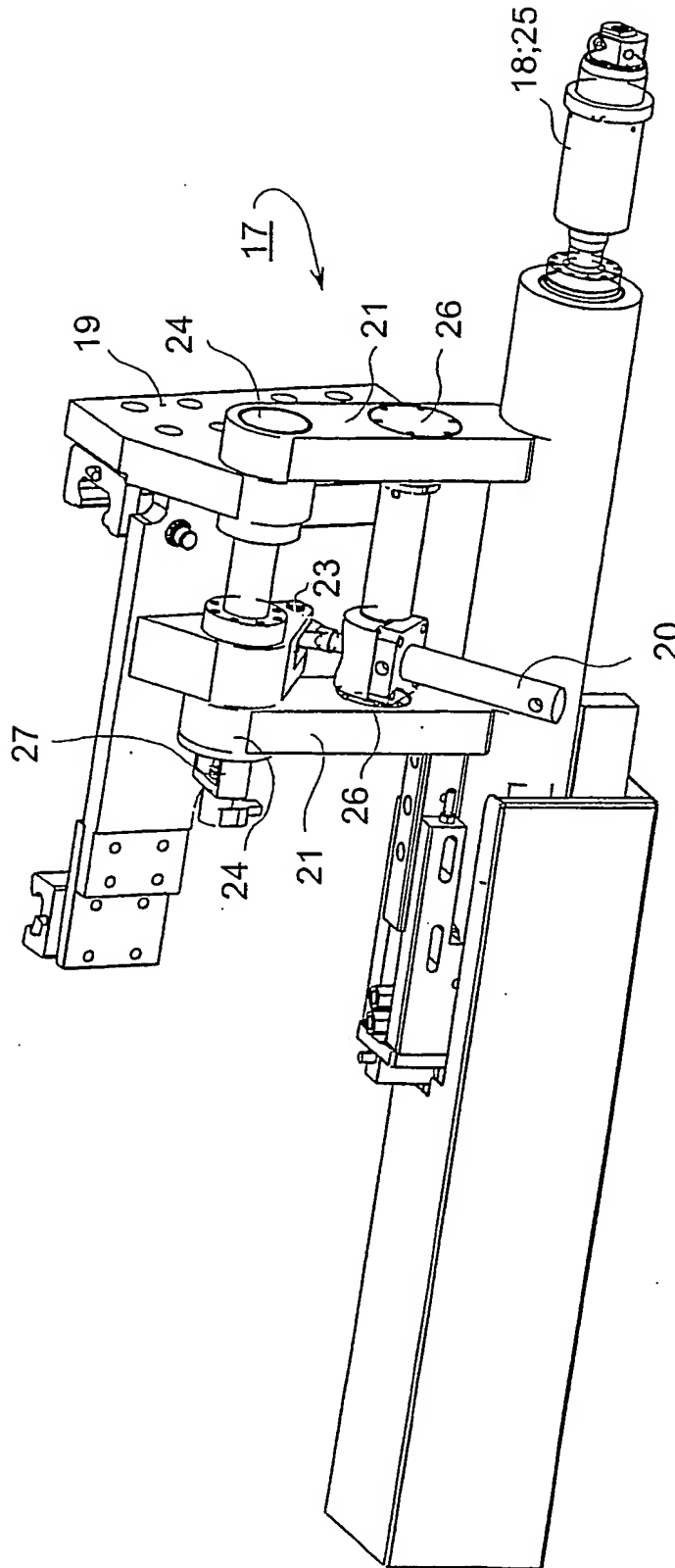


FIG. 3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/ 03/00853

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B65H18/10 B65H10/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,A	WO 03 089352 A (WINDO KEVIN P ; VALMET ATLAS PLC (GB)) 30 October 2003 (2003-10-30) the whole document ---	1-10
A	US 5 620 151 A (UEYAMA MINORU ET AL) 15 April 1997 (1997-04-15) the whole document ---	1-10
A	EP 0 887 293 A (VOITH SULZER FINISHING GMBH) 30 December 1998 (1998-12-30) the whole document ---	1-10
A	US 4 887 926 A (KUNZ UDO) 19 December 1989 (1989-12-19) the whole document ---	1-10
	--- -/--	

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

31 March 2004

Date of mailing of the international search report

23. 04. 04

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

TEIJA RASCH / ELY

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 03/00853

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 841 305 A (JAGENBERG WERKE AG) 13 July 1960 (1960-07-13) the whole document ---	1-10
A	DE 40 17 732 A (GOEBEL GMBH MASCHF) 5 December 1991 (1991-12-05) the whole document ---	1-10
A	EP 1 108 669 A (VOITH PAPER PATENT GMBH) 20 June 2001 (2001-06-20) the whole document -----	1-10

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/JP 03/00853

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 03089352	A	30-10-2003	WO 03089352 A1	30-10-2003
			GB 2388106 A	05-11-2003
US 5620151	A	15-04-1997	JP 2033764 C	19-03-1996
			JP 6234444 A	23-08-1994
			JP 7053547 B	07-06-1995
			JP 2545331 B2	16-10-1996
			JP 7017659 A	20-01-1995
			JP 7024779 A	27-01-1995
			DE 4403330 A1	11-08-1994
			GB 2274835 A ,B	10-08-1994
EP 0887293	A	30-12-1998	DE 19727327 A1	07-01-1999
			DE 59806149 D1	12-12-2002
			EP 0887293 A2	30-12-1998
US 4887926	A	19-12-1989	DE 3822106 C1	11-01-1990
			DE 8816525 U1	19-10-1989
			EP 0348806 A2	03-01-1990
			JP 2086526 A	27-03-1990
			JP 4076897 B	04-12-1992
GB 841305	A	13-07-1960	NONE	
DE 4017732	A	05-12-1991	DE 4017732 A1	05-12-1991
EP 1108669	A	20-06-2001	DE 19960000 A1	05-07-2001
			EP 1108669 A2	20-06-2001